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INSECTS IN RELATION
TO
NATIONAL DEFENSE

Circular 18

SCREWORMS



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Table of Contents

	Page
Introduction.....	1
Distribution.....	2
How Man and Animals Are Attacked.....	2
Life History and Stages.....	3
Methods and Rapidity of Spread.....	5
Control.....	6
Methods of Avoiding Attack on Man.....	6
Methods of Avoiding Attack on Horses and Mules.....	7
Prevention of wounds.....	7
Treatment of wounds.....	7
Burning of carcasses.....	7
Treatment of Human Infestations.....	9
Treatment of Infestations in Animals.....	9
Source of the Materials.....	12
References.....	13

INTRODUCTION

The adult of the true screwworm (Cochlio-
myia americana C. & P.) is a bluish-green fly
that in its maggot stage lives as a true para-
site of man and other warm-blooded animals.
It is a native of the Americas and is largely
confined to the warmer climates, though during
summer it may extend its ravages to the cooler
regions. The extent of loss in countries other

than the United States has never been computed, but in this country the annual loss has been estimated at 5 to 10 million dollars.

This loss is caused mainly by the penetration of the larvae into wounds of livestock and infestations of the naso-pharyngeal region in man. No specific disease is known to be carried by this insect, although it may introduce into wounds various disease organisms.

DISTRIBUTION

The screwworm is present in the southern portions of the United States, Central America, Mexico, the West Indies, and throughout South America, except the southern portion.

In this country it overwinters normally only in southern Texas, along the Balcones Escarpment from Del Rio to San Antonio, and southward; in extreme southern Georgia and throughout Florida; in southern Arizona and extreme southern California. As the season advances it moves northward from the overwintering area in Texas, sometimes as far as Nebraska, Iowa, Illinois, Indiana, and from the overwintering area in the Southeast to Tennessee and to northern Alabama and South Carolina. The screwworm infests large areas in Arizona and New Mexico, and in California it occasionally invades the Sacramento Valley.

HOW MAN AND ANIMALS ARE ATTACKED

The flies are attracted to wounds of various types upon which they feed and lay eggs. Even slight bloody discharges are attractive, as in the case of men with nasal catarrh. The larvae, upon hatching, start feeding in the

wound, causing extensive destruction of tissue and a bloody discharge of a peculiar, fetid odor which is highly attractive to flies of all kinds. These in turn infest the wound, and if neglected it is enlarged rapidly. The tissues around the infested wound become greatly swollen and pockets are eaten out beneath the skin. The infested man or animal may die due to tissue destruction and the poisons absorbed from the wound. Screwworms do not breed in carcasses, but if the worms are 2 days old or more when the animal dies they may complete their growth in the carcass. Blowflies sometimes initiate infestations in wounds and often occur in wounds after an initial attack by screwworms. These blowflies breed in carcasses (Circular 8).

Horses and mules are most frequently attacked in scratches, wire cuts, saddle and harness sores, and in the sheaths owing to local irritation.

LIFE HISTORY AND STAGES

The adult of the screwworm is a bluish-green medium-sized fly with three dark stripes on the thorax, Fig. 1. It deposits dense masses of whitish eggs. These are stuck firmly together and to the tissue around the wound, Fig. 2. The flies live from 2 to 10 weeks and deposit from 2 to 12 masses of eggs. The eggs hatch in 11 to 21 hours. The larvae feed close together and are usually seen with the head downward and the blunt tail end upward for breathing. When full-grown, the larvae are about $\frac{2}{3}$ of an inch long and appear pinkish in color and the rings of spines around the body are rather prominent, Fig. 3. The larvae



Figure 1 - Screwworm fly (note the three dark stripes on thorax).

become full-grown in 4 to 10 days and crawl out of the wound, drop to the ground, and burrow into the soil $\frac{1}{4}$ to 2 inches. The pupa, or resting stage, Fig. 4, is passed in the soil in about 7 or 8 days in warm weather and it may last 2 months during the winter.

Soon after the flies emerge from the soil they mate, feed, and are ready to lay eggs in 5 to 10 days.

The total cycle is completed in 18 to 30 days during the warmer months.



Figure 2 - Fly depositing mass of eggs on a wound.



Figure 3 - Larva (note rings of spines).

METHODS AND RAPIDITY OF SPREAD

The flight of the screw-worm fly is strong and it has been found that the pest migrates northward with the advent of warm weather at the rate of about 35 miles a week. The pest is easily transported as worms in wounds, and often infested horses, cattle, or sheep are transported long distances and the insect is thus introduced into

uninfested territory many miles in advance of natural spread. In such locations it may persist until killed by frost and under favorable conditions pass through several generations.

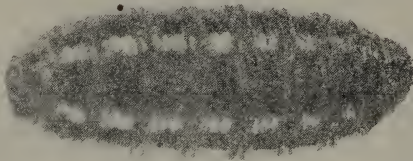


Figure 4 - Pupa.

CONTROL

As screwworms breed in so many kinds of animals and as the flies spread widely, control in military bases and in the field must depend largely on prevention of attack. The cooperation of livestock owners in the vicinity of camps may well be sought, looking toward the avoidance of wounds during periods when screw-worm flies are active, and the prompt treatment of all cases to prevent the maturing of worms.

Methods of Avoiding Attack on Man

Hospitals should be well screened. Bloody bandages and clothing should be disposed of promptly.

Men should avoid sleeping during the day in screwworm territory without having the pro-

tection of screens or bed nets. Those with wounds or nasal catarrh should be especially careful not to expose themselves.

Methods of Avoiding Attack on Horses and Mules

Prevention of wounds.--Injury of animals should be avoided as much as possible. Properly fitted harnesses and good saddle blankets prevent sores that may become infested. Branding and other operations that may lead to screw-worm infestations should be performed, if possible, during periods when screwworm flies are inactive or the animals should be confined and the wounds watched until healed.

Treatment of wounds.--The recently developed ointment or smear referred to as Formula No. 62 (see Circular E-540 in list of references) is an excellent wound protector. Painting wounds with pine tar oil (sp. gr. 1.065, acid and water free) or pressing into them a small quantity of finely ground diphenylamine crystals prevents infestation for 1 to 3 days, but the wounds should be watched until completely healed. Severely wounded or infested animals are best kept in screened stalls until the wound is partially healed.

Burning of carcasses.--Carcasses of all animals should be promptly burned. This prevents the breeding of swarms of blowflies, and if the animal was infested with screwworms when it died, also prevents the maturing of these parasites.

The burning of a large carcass is most easily accomplished by digging a trench in the ground along the back of the animal. This should be about the length of and slightly nar-

rower than the carcass and about 12 to 16 inches deep. The trench is then filled with wood, including some heavy sticks, and the carcass is rolled over onto it. A fire is started at the windward end, Fig. 5. In the course of a few hours the carcass is completely consumed, if the head and hoofs are pushed back on the fire after the burning has progressed awhile.



Figure 5 - Burning of carcasses - prevents the breeding of blowflies.

TREATMENT OF HUMAN INFESTATIONS

Early detection and treatment of human infestations is important. Nasal infestations are frequently not diagnosed for some time. Pain, local swelling, the sensation of crawling, and the presence of a bloody discharge are diagnostic features. The physician can often see some of the larvae on careful examination.

Ether, chloroform, or benzol, introduced into the nose with an atomizer or on a pledget of cotton, followed by a blocking of the nostrils with dry cotton, will usually anesthetize the larvae and they can be removed with forceps or by blowing the nose. In severe cases care should be taken to avoid rupturing blood vessels that may be exposed by the larvae. Sometimes a second or third application of the anesthetic is necessary to dislodge all of the larvae, each application for 2 or 3 minutes. After the larvae are removed the care of the case is similar to that of other wounds.

TREATMENT OF INFESTATIONS IN ANIMALS

Commercial benzol (90%), applied to the infested wounds with a rubber bulb syringe, is excellent for killing the screwworms. If the wound contains much pus or blood it should be removed first with a cotton swab. The benzol checks the bleeding. After a minute or two more benzol is applied and a cotton plug lightly inserted in the opening. In 3 to 5 minutes the larvae should be dead and the cotton and larvae should be picked out with a pair of sterile blunt forceps, and the blood and pus cleaned from around the wound. If blood is flowing, apply more benzol and then paint the wound with pine tar oil, or if the animal is not going to

be examined and painted with the fly repellent daily, press into the wound a small amount of finely ground diphenylamine crystals.

A combination screwworm killer and wound protector has been developed recently by the Bureau of Entomology and Plant Quarantine. This ointment or smear, known as Formula No. 62, is composed of the following:

Diphenylamine	
(technical grade).....	3½ parts by weight
Benzol	
(commercial).....	3½ parts by weight
Turkey red oil	
(pH-10 or neutral).....	1 part by weight
Lamp black.....	2 parts by weight

The diphenylamine is dissolved in the benzol, preferably by placing the two substances together and allowing them to stand 12 or 24 hours. In no event should the dissolving of the diphenylamine in benzol be attempted by heating over an open flame. Benzol is highly inflammable and should be kept away from flames and lighted cigarettes or cigars. If heat is used to hasten solution, the container holding the benzol and diphenylamine may be placed in a vessel of hot water, the container being left uncorked until the diphenylamine is dissolved.

After the diphenylamine is dissolved the turkey red oil is added and the mixture thoroughly shaken. The lamp black is then stirred in gradually and the mixing continued until the compound attains a smooth, even texture of about the consistency of molasses. It is then ready for use. The remedy is best applied with a 1-inch paint brush.

The following precautions should be taken in preparing and using screwworm smear No. 62.

1. Prepare the remedy well away from open flames and do not have lighted cigarettes or cigars around during the process.

2. Benzol, in the form in which it occurs in the smear, is highly volatile and will evaporate quickly from the smear if left in an open container. It is therefore advisable that the smear be kept tightly covered in a cool place when not in use. It is also recommended that only an amount necessary for a few days' use be removed at a time from the larger supply container. Even when animals are actually being treated the container should be kept covered as much as possible. In case the smear, through evaporation, becomes too thick for easy application, an additional amount of benzol may be stirred in to bring it back to its original consistency.

3. When infestations located near the eyes are being treated, care should be taken not to get an excessive amount of the smear into the unaffected parts of the eye. If this is done accidentally it is advisable to wash the eye immediately with plain water, as the material is irritating to the eyes.

4. Do not add oil, grease, or any other substances to the formula, or its efficiency will be greatly impaired, if not entirely destroyed.

When using diphenylamine crystals or Formula No. 62, the treatment need be applied only every third or fourth day until the wound is healed.

New treatments and control procedures are being developed that are especially applicable to ranch conditions where farmers and stockmen may cooperate in suppressive operations on a large scale. If new problems arise, additional information will be supplied by the Bureau of Entomology and Plant Quarantine, upon request.

Source of the Materials

For the information of those who wish to purchase the ingredients for the mixing of this smear there is given below a list of companies which manufacture them. No claim is made that the list is complete, nor is any guarantee here expressed or implied for the products of the companies listed.

Diphenylamine should be obtainable from the larger wholesale drug companies in screwworm-infested territory. It is manufactured by the following companies:

E. I. Du Pont de Nemours & Company, Inc.,
Wilmington, Delaware.
Lederle Laboratories, Inc., 30 Rockefeller
Plaza, New York, N. Y.
Eastman Kodak Company, Chemical Sales Division,
Rochester, N. Y.
The Dow Chemical Company, Midland, Michigan.

Turkey red oil is manufactured by the following companies:

Apex Chemical Company, Inc., 200-214 So.
First Street, Elizabethport, N. J.
L. Sonneborn Sons, Inc., 88 Lexington
Avenue, New York, N. Y.

Lamp black is manufactured by the following companies:

General Carbon Company, Los Angeles, Calif.
The L. Martin Company (Germantown Eagle or
Velvet Brand), Tacony, Pa.
Whittaker, Clark & Daniels, Inc., 260 West
Broadway, New York, N. Y.

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